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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

[0001]

[Industrial Application]This invention relates to improvement of a ceiling flush type air conditioner.

[0002]

[Description of the Prior Art]Usually, the ceiling flush type air conditioner (henceforth a turbo fan type ceiling embedded air conditioner) using a turbo fan has structure as shown in drawing 13 (JP,3-39828,A). In this turbo fan type ceiling embedded air conditioner, the outlet 2 of the turbo fan 1 was countered and the heat exchanger 3 is arranged vertically. The above-mentioned heat exchanger 3 is what is called a cross fin heat exchanger, and outline composition is carried out from the rigid tabular fin arranged in parallel so that the cross fin coil arranged in parallel with plural lines and this cross fin coil might be intersected. Therefore, this cross fin heat exchanger lacks in the flexibility of an installation mode, and is arranged with a simple racetrack-like gestalt around the turbo fan 1.

[0003]As other ceiling flush type air conditioners, there is a ceiling flush type air conditioner (henceforth a cross flow fan type ceiling embedded air conditioner) using a cross flow fan as shown in drawing 16. To the cross flow fan 12, the upper part is aslant moved to the anti-cross flow fan position, and he arranges the cross fin heat exchanger 11 in parallel, and is trying to press down the height of a ceiling flush type air conditioner low in this cross flow fan type ceiling embedded air conditioner.

[0004]

[Problem(s) to be Solved by the Invention]As mentioned above, in the above-mentioned turbo fan type ceiling embedded air conditioner, since the flexibility of arrangement forms is missing, the above-mentioned cross fin heat exchanger 3 can be arranged only with a simple racetrack-like gestalt. Therefore, in order to secure a predetermined heat exchange surface product, the height of a heat exchanger cannot be made low. In the case of the turbo fan type ceiling embedded air conditioner of 2 ream type which installed two turbo fans side by side, in accordance with the circumference of a turbo fan, a heat exchanger cannot be arranged so that the distance from the wing tip of two turbo fans may be maintained at profile regularity over the perimeter. That is, in the turbo fan type ceiling embedded air conditioner using the cross fin heat exchanger 3, there is a problem that miniaturization and improvement in heat exchanging efficiency are difficult.

[0005]Since the above-mentioned cross fin heat exchangers 3 surround the circumference of the turbo fan 1 and are arranged, the fin of the cross fin heat exchanger 3 is arranged by the approximately radial centering on the center of rotation of the turbo fan 1. Therefore, the air which blew off from the outlet 2 of the turbo fan 1 to the hand of cut (namely, tangential direction to the periphery of the turbo fan 1) will hit the field of the above-mentioned fin, and also has the problem that air resistance becomes large.

[0006]The above-mentioned turbo fan type ceiling flush type air conditioner, As shown in drawing 14, the air which took to rotation of the turbo fan 1 and was inhaled by the central part blows off from the outlet 2 of the impeller 4 toward the heat exchanger 3, and after it passes the heat exchanger 3, it has structure which changes a direction downward rapidly and blows off indoors with the side attachment wall 5. Therefore, there is a problem that air resistance becomes large and causes a noise rise and ability degradation.

[0007]The rate of flow of the air which blew off from the above-mentioned impeller 4 has a large velocity distribution small with the down side with the up side, as shown in drawing 15. Therefore, the heat exchanger 3 upper part will differ in the heat exchanging quantity by the heat exchanger 3 from the bottom, and there is also a problem that channeling arises on the refrigerant path in the heat exchanger 3, and heat exchanging efficiency falls.

[0008]In the above-mentioned cross flow fan type ceiling embedded air conditioner, as shown in drawing 16, the drain pan 13 is allocated under the lowermost end of the cross fin heat exchanger 11, and the drain which is transmitted to the fin 14, and flows and falls is received. however, the drain adhering to the surface of the cross fin coil 15 which intersected perpendicularly with the above-mentioned fin 14, crossed the air duct, and was arranged was formed in the suction opening 16 -- it will aim air filter 17 and will fall. Then, along with the cross fin heat exchanger 11, he forms the 2nd drain pan 18 of the shape of a child of a reed screen in the undersurface side of the cross fin heat exchanger 11, and is trying to receive the drain which falls from the cross fin coil 15.

[0009]As a result, in a cross flow fan type ceiling embedded air conditioner as shown in drawing 16, while the space for the 2nd drain pan attachment is required, there is a problem of causing a cost hike. Since the 2nd drain pan 18 of the above crosses an air duct and is arranged, it also has the problem that air resistance causes increase, an air-capacity down, and a noise rise. Heat exchanging efficiency falls for usable area reduction of the heat exchanger 11, and an air-capacity down, and area increase of the heat exchanger 11 is caused. Therefore, there is also a problem that miniaturization cannot be attained so that it may consider.

[0010]Then, the purpose of this invention is for miniaturization, low-noise-izing, or a cost cut to provide a ceiling flush type air conditioner with possible high heat exchanging efficiency easily.

[0011]

[Means for Solving the Problem]In order to attain the above-mentioned purpose, an invention concerning claim 1, Are a ceiling flush type air conditioner which provides a heat exchanger in the suction side air duct between a suction opening and a fan, or the blow-off side air duct between a fan and an outlet, and the above-mentioned heat exchanger, It is characterized by being a mesh fin heat exchanger which adheres a mesh fin of mesh shape to an outside surface of a heat exchanger tube arranged by surface state.

[0012]It is a ceiling flush type air conditioner of an invention concerning claim 1, and is characterized by the above-mentioned mesh fin heat exchangers' 25 and 35 having moved the upper part to the anti-fan position aslant, and allocating them so that an invention concerning claim 2 may be illustrated to drawing 1.

[0013]An invention concerning claim 3 so that it may illustrate to drawing 10 thru/or drawing 12,Are a ceiling flush type air conditioner of an invention concerning claim 2, and the above-mentioned fan is

the turbo fan 33, and the above-mentioned mesh fin heat exchanger 72, Provide a fold in the both-ends neighborhood [ of the mesh fin 68 of a rectangle which adhered to an outside surface of the heat exchanger tube 65 arranged by surface state ] 69, and one side 70 side of the tubed mesh fin heat exchange member 71 which connected and accomplished 69 comrades, and it is formed so that an average caliber of the one above-mentioned side 70 may become narrower than a caliber of other sides, It is characterized by having surrounded the above-mentioned turbo fan 33 and being allocated.

[0014]An invention concerning claim 4 is a ceiling flush type air conditioner of an invention concerning claim 1, as illustrated to drawing 6, The above-mentioned fan is the turbo fan 33, and the above-mentioned mesh fin heat exchanger 47 is characterized by being allocated so that an entrance of the passage 40 which is in the blow-off side air duct 34 between the above-mentioned turbo fan 33 and the outlet 32, and opens the above-mentioned blow-off side air duct 34 and the outlet 32 for free passage may be plugged up.

[0015]An invention concerning claim 5 is a ceiling flush type air conditioner of an invention concerning claim 1, as illustrated to drawing 5, The above-mentioned fan is the cross flow fan 23, and the above-mentioned mesh fin heat exchanger 46 is characterized by having been in the suction side air duct 24 between the suction opening 22 and the above-mentioned cross flow fan 23, having surrounded the side of the above-mentioned cross flow fan 23 perpendicularly, and being allocated.

[0016]

[Function]In the invention concerning claim 1, the mesh fin heat exchanger is provided in the suction side air duct between the suction opening and fan in a ceiling flush type air conditioner, or the blow-off side air duct between a fan and an outlet. Since the mesh fin of mesh shape is stuck and formed in the outside surface of the heat exchanger tube arranged by surface state, this mesh fin heat exchanger has flexible nature.

And drain omission is not carried out even if it makes it incline.

Therefore, the above-mentioned mesh fin heat exchanger has big flexibility in an installation mode, and miniaturization of a ceiling flush type air conditioner, low-noise-izing, cost cut, or high temperature efficiency-ization is attained by taking the installation mode according to each purpose.

[0017]In the invention concerning claim 2, the above-mentioned mesh fin heat exchangers 25 and 35 move the upper part to the anti-fan position aslant, and are allocated. Therefore, a desired heat exchange surface product can be obtained pressing down the whole height, airstream inside the plane is smoothed, and low-noise-izing and improvement in heat exchanging efficiency are achieved. In that case, since the drain omission of the above-mentioned mesh fin heat exchangers 25 and 35 is not carried out, they do not need the 2nd drain pan, but neither the unnecessary increase in noise nor the decline in heat exchanging efficiency produces them at it.

[0018]In the invention concerning claim 3, move the upper part to the anti-turbo fan 33 position aslant, and the mesh fin heat exchanger 72 which can be allocated, A fold is provided in the both-ends neighborhood [ of the mesh fin 68 of the rectangle which adhered to the outside surface of the heat exchanger tube 65 arranged by surface state ] 69, and one side 70 side of the tubed mesh fin heat exchange member 71 which connected and accomplished 69 comrades, and it is formed by making the average caliber of the one above-mentioned side 70 narrower than the caliber of other sides. In

this way, it is formed simply, and the mesh fin heat exchanger 72 which can attain miniaturization of the above-mentioned ceiling flush type air conditioner, low-noise-izing, cost cut, or high temperature efficiency-ization encloses the above-mentioned turbo fan 33, and is allocated.

[0019]The air after heat exchange was carried out by the mesh fin heat exchanger 47 allocated so that the invention concerning claim 4 might close the entrance of the passage 40 which opens the above-mentioned blow-off side air duct 34 and the outlet 32 for free passage to the blow-off side air duct 34 between the turbo fan 33 and the outlet 32, It blows off from the outlet 32 indoors via the above-mentioned passage 40, without touching the side attachment wall of a casing. In this way, since dewing in the above-mentioned casing is prevented, thermal insulation becomes unnecessary, and a cost cut and miniaturization are attained.

[0020]The indoor air incorporated from the admission port 22 by rotation of the cross flow fan 23 in the invention concerning claim 5, It is in the suction side air duct 24 between the above-mentioned suction opening 22 and the cross flow fan 23, passes through the inside of the mesh fin heat exchanger 46 which surrounded the side of the above-mentioned cross flow fan 23 perpendicularly, and was allocated, and results in the above-mentioned cross flow fan 23. As a result, the difference between positions of the angle to the mesh fin heat exchanger 46 of the streamline of airstream produced by rotation of the above-mentioned cross flow fan 23 becomes small, and the fall of energy loss is achieved.

[0021]

[Example]Hereafter, the example of a graphic display of this invention explains in detail. This invention aims at miniaturization of a ceiling flush type air conditioner, low-noise-izing, efficient-izing, or a cost cut by using the mesh fin heat exchanger which used the fin of mesh shape as a heat exchanger for ceiling flush type air conditioners.

[0022]Drawing 1 is drawing of longitudinal section in the ceiling flush type air conditioner concerning this example. Drawing 1 (a) is the example which applied this invention to the cross flow fan type ceiling embedded air conditioner, and drawing 1 (b) is the example which applied this invention to the turbo fan type ceiling embedded air conditioner.

[0023]In the above-mentioned cross flow fan type ceiling embedded air conditioner, As shown in drawing 1 (a), to the suction side air duct 24 between the suction opening 22 provided in the undersurface by the side of one of the air conditioner body 21, and the cross flow fan 23 allocated in the other sides in the air conditioner body 21 by the longitudinal direction. In parallel [ heat exchanger / 25 / tabular / mesh fin ] to the cross flow fan 23, the upper part is moved to the anti-cross flow fan position, and is allocated aslant. 26 is a drain pan which receives the drain which is transmitted to the mesh fin heat exchanger 25, and flows and falls, 28 is a drain pan which receives the drain which falls from the part of the U bend in the mesh fin heat exchanger 25, and 27 is an outlet.

[0024]In the above-mentioned turbo fan type ceiling embedded air conditioner on the other hand, As shown in drawing 1 (b), to the blow-off side air duct 34 between the turbo fans 33 which are formed in the center section in the outlet 32 provided in the undersurface in the periphery of the air conditioner body 31, and the air conditioner body 31, and have the axis of rotation perpendicularly. The upper part is aslant moved to the anti-turbo fan position for the mesh fin heat exchanger 35, and the turbo

fan 33 is surrounded and allocated. 36 is a drain pan and 37 is a suction opening.

[0025]Here, the above-mentioned mesh fin heat exchanger is explained. The above-mentioned mesh fin heat exchanger adheres, and the heat exchanger tubes 42 and 42 which are shown in drawing 2 and which were arranged at equal intervals like and the mesh fin 41 of -- formed in mesh shape along the outside surface are formed. Thus, since the mesh fin 41 in a mesh fin heat exchanger is formed in mesh shape, unlike the rigid fin in the case of an above-mentioned cross fin heat exchanger, it has flexible nature. Drawing 2 shows the example which changed the above-mentioned mesh fin heat exchanger into the inverted-U character form section.

[0026]Drawing 3 shows the drain omission limit in a heat exchanger. The curve A in drawing 3 expresses the angle of inclination  $\theta$  and wind speed of a heat exchanger in the time of the drain omission in the case of having arranged the mesh fin heat exchanger so that the heat exchanger tube 42 may become a lengthwise direction (perpendicular direction) arising. Like the following, the curves B are the angle of inclination / wind-speed curve in the case of having arranged the mesh fin heat exchanger so that the heat exchanger tube 42 may become a transverse direction (horizontal), and the curves C are the angle of inclination / wind-speed curve in the case of a cross fin heat exchanger. In any case of a curve, a slash field is an usable range. In the case of a mesh fin heat exchanger, compared with the cross fin heat exchanger, the drain omission limit spreads out in the one where an angle of inclination is larger, and it is strong to drain omission so that clearly from drawing 3. When especially a wind speed is 2.0 or less m/s, drain omission is not carried out even if an angle of inclination is 90 degrees (namely, horizontal arrangement). Drawing 3 is the measured value in the case where it is in a near state (state in which the oil etc. adhered to the surface) according to condition of use with a actual heat exchanger. Therefore, in being a heat exchanger to which the oil etc. have not adhered, it is further hard to carry out drain omission.

[0027]In drain omission, in drawing 1, the angle of inclination  $\theta$  does not carry out the mesh fin heat exchangers 25 and 35 to about 60 degrees at 4.0 or less m/s of wind speeds as mentioned above. Therefore, it is not necessary to provide the 2nd drain pan the mesh fin heat exchanger 25 and directly under 35. It is \*\*\*\* about the following effects that this 2nd drain pan is unnecessary.

[0028]In the case of the cross flow fan type ceiling embedded air conditioner shown in drawing 1 (a), Since space for the 2nd DOREIPAN installation is not needed for directly under [ in the suction side air duct 24 / mesh fin heat exchanger 25 ], Rather than the conventional cross flow fan type air conditioner shown in drawing 16, the angle of inclination of the mesh fin heat exchanger 25 can be enlarged further, and slimming down of the air conditioner body 21 can be attained. Since what bars the flow of air in the above-mentioned suction side air duct 24 is lost, air resistance decreases. Therefore, heat exchanging efficiency increases, a heat exchange surface product can be decreased, and the further miniaturization is attained. Air capacity is increased and low noise-ization can also be attained. Since passage wind-speed distribution of the above-mentioned mesh fin heat exchanger 25 improves, it becomes still the rise of heat exchanging efficiency, low-noise-izing, and more nearly miniaturizable.

[0029]Also in the case of the turbo fan type ceiling embedded air conditioner shown in drawing 1 (b), the mesh fin heat exchanger 35 can be aslant arranged using the angle of inclination of the drain omission limit of a mesh fin heat exchanger being large, and slimming down of the air conditioner

body 31 can be attained to it. In that case, since the 2nd drain pan is unnecessary, the noise rise by the increase in air resistance, the heat-exchanging-efficiency down due to the passage wind-speed distribution fall of a heat exchanger, etc. are not.

[0030]In the case of the turbo fan type ceiling embedded air conditioner shown in drawing 1 (b), the following effects are also done so. That is, arrangement adapted to the blow-off characteristic (the rate of flow is as large as the upper part) of the turbo fan shown in drawing 15 can be taken by moving aslant the mesh fin heat exchanger 35 upper part to the anti-turbo fan position as mentioned above, and surrounding and allocating the turbo fan 33. As a result, the heat exchanging quantity in the mesh fin heat exchanger 35 becomes uniform with the upper part and the down side, channeling does not arise on the refrigerant path in the mesh fin heat exchanger 35, and the heat exchange characteristic can fully be pulled out. The flow of each refrigerant path can be made still more uniform by arranging the mesh fin heat exchanger 35 in that case, so that the heat exchanger tube may become perpendicularly.

[0031]Big space is generated between turbo fan 33 wing tip and the mesh fin heat exchanger 35 by pushing down aslant the above-mentioned mesh fin heat exchanger 35 upper part, and allocating it in the anti-turbo fan side. Then, the outer diameter of the turbo fan 33 can be enlarged, fan capability can be raised, and low noise-ization can also be attained. In addition, while heat exchange is carried out by the mesh fin heat exchanger 35 in which the air which blew off from the above-mentioned turbo fan 33 moved the upper part to the anti-turbo fan position aslant, and was allocated, its direction can be turned smoothly, air resistance can be made small, and the further noise reduction and prevention from ability degradation can also be aimed at.

[0032]Since there is no broad tabular fin which interrupts the flow of air in the above-mentioned mesh fin heat exchanger 35, the air which blew off from the outlet of the turbo fan 33 to the hand of cut can pass through the inside of the mesh fin heat exchanger 35, without being interfered by the fin, and increase of the rate-of-flow resistance by a heat exchanger is prevented.

[0033]Drawing 4 shows the example which made the heat exchange surface product of the above-mentioned mesh fin heat exchanger increase, and aimed at the further miniaturization of a ceiling flush type air conditioner, or the increase in air-conditioning capability. In each following example, the same number as drawing 1 is given to the same parts as drawing 1, and explanation is omitted. Also in any of drawing 4 (a), drawing 4 (b), and drawing 4 (c), the heat exchange surface product is earned by making the mesh fin heat exchangers 43, 44, and 45 crooked in a character [ "through which it passes" ]-like section. Therefore, if the same product dimension as the ceiling flush type air conditioner shown in drawing 1 is made, heat exchanging capacity can be heightened. On the contrary, if the same heat exchanging capacity as the ceiling flush type air conditioner shown in drawing 1 is made, the project area of the mesh fin heat exchangers 43, 44, and 45 can be made small, and miniaturization can be attained.

[0034]Drawing 5 shows the example of the ceiling flush type air conditioner which can attain the further miniaturization. The above-mentioned mesh fin heat exchanger in this example is arranged so that the side of the cross flow fan 23 may be surrounded perpendicularly, as shown in drawing 5. By carrying out like this, the difference between positions of the angle to the mesh fin heat exchanger 46 in the streamline of airstream produced by rotation of the cross flow fan 23 becomes small. Therefore,

the pressure loss at the time of mesh fin heat exchanger 46 passage becomes small, and energy loss becomes small. That is, the degradation of the above-mentioned cross flow fan 23 becomes small.

[0035]The project area of the mesh fin heat exchanger 46 can be substantially made small by arranging the mesh fin heat exchanger 46 as mentioned above, so that the side of the cross flow fan 23 may be surrounded perpendicularly. Therefore, miniaturization can be attained crosswise about 20% to the cross flow fan type ceiling embedded air conditioner shown in drawing 1 (a).

[0036]Drawing 6 is a sectional view of the turbo fan type ceiling embedded air conditioner in a further different example. As shown in drawing 6, the mesh fin heat exchanger 47 in this example curves in an inverted-U character section, and it is arranged so that the circumference of the turbo fan 33 may be surrounded. And the air which was inhaled by rotation of the above-mentioned turbo fan 33 from the suction opening 37, and blew off from the wing tip of the turbo fan 33 by it reaches the upside surface of the mesh fin heat exchanger 47. The air which heat exchange was carried out and blew off from the lower surface when passing the mesh fin heat exchanger 47 passes the opening in an inverted-U character section, passes through the passage 40 which is formed between the two drain pans 36 and 38, and opens the blow-off side air duct 34 and the outlet 32 for free passage, and goes to the outlet 32.

[0037]as [ touch / the side attachment wall 39 / the end of the outside of the mesh fin heat exchanger 47 which has the above-mentioned reverse U section in that case is located in the bottom of the side attachment wall 39 of the air conditioner body 31, is inserted into the drain pan 38, and / end / directly ] -- it is. That is, the air after heat exchange was carried out by the mesh fin heat exchanger 47 blows off from the outlet 32 indoors, without touching the side attachment wall 39. As a result, in this example, it does not dew inside the side attachment wall 39. Therefore, inside the side attachment wall of the heat exchanger body 31, as the dashed line showed, it is not necessary to spread thermal insulation around in drawing 1 (b) and drawing 4 (c), and a cost cut and miniaturization can be attained.

[0038]Drawing 7 is a cross-sectional view of the turbo fan type ceiling embedded air conditioner in a further different example. In the above-mentioned turbo fan type ceiling embedded air conditioner, in the air conditioner body 31 which accomplishes the box of an approximately square as shown in drawing 7, the circular turbo fan 33 is dedicated and it is formed. Therefore, a quite large opening exists in the four corners 51 of the air conditioner body 31. Then, in this example, the mesh fin heat exchangers 52, 53, and 54 are not only spread around the form with a simple rectangle circular around the turbo fan 33 or, Using the flexible nature which the mesh fin heat exchangers 52, 53, and 54 have, it is made to curve in the opening of the four corners 51 of the air conditioner body 31, and a fold is formed.

[0039]By carrying out like this, the heat exchange surface product of the above-mentioned mesh fin heat exchangers 52, 53, and 54 is earned, and heat exchanging quantity is raised. drawing 7 (a), drawing 7 (b), and drawing 7 (c) -- opening \*\*\*\* of the four above-mentioned corners 51 each -- the various curves at the time of incurvating the mesh fin heat exchangers 52, 53, and 54 carry out, and the example of a way is shown.

[0040]Next, it is a mesh fin heat exchanger for the above-mentioned turbo fan type ceiling embedded air conditioners, and easy processing explains easily the example of the mesh fin heat exchanger

which can be formed, often pulling out the characteristic.

[0041]The methods with easy No. 1 for forming the mesh fin heat exchanger which moves the upper part to the anti-turbo fan position aslant, and can enclose and allocate a turbo fan from the mesh fin heat exchange member which has structure as shown in drawing 2, and accomplishes plate-like as shown in drawing 1 (b) are the following methods. That is, four piece of trapezoid mesh fin heat exchange members 55 which constitute the development view shown in drawing 8 are formed. And the oblique sides of each mesh fin heat exchange member 55 formed as this another piece are connected, and the mesh fin heat exchanger of reverse square weight is formed.

[0042]However, the mesh fin heat exchange member 55 of each trapezoid formed as another piece must be assembled in this case, and although it is a method with easy No. 1, formation of a mesh fin heat exchanger is troublesome. Since the heat exchanger tube 50 is not arranged at each oblique line part field (b) of each mesh fin heat exchange member 55 as the distance between the four corners of a mesh fin heat exchanger and turbo fan periphery which were formed in the shape of reverse square weight separates and it is shown in drawing 8, the heat exchanging efficiency in four corners will fall.

[0043]The upper part is aslant moved to the anti-turbo fan position, and methods of forming the mesh fin heat exchanger which maintains the wing tip of the above-mentioned turbo fan and regular intervals, encloses the circumference of this turbo fan, and can be allocated in reversed conical shape include the following methods. That is, as shown in drawing 9 (a), the heat exchanger tube 56 of a mesh fin heat exchanger is radiately arranged in the position of the bus line in a conic development view. And it adheres along the heat exchanger tubes 56 and 56 arranged in the mesh fin 57 of one sheet formed circularly at the above-mentioned radial, and the outside surface of --, and the mesh fin heat exchange member 64 is formed. Next, the both-ends neighborhoods 58 and 58 of the mesh fin heat exchange member 64 formed in this way are connected, and the mesh fin heat exchanger of reversed conical shape is formed.

[0044]Since that cross section is a round shape, in the case of this mesh fin heat exchanger, it can enclose all the peripheries of a turbo fan at equal intervals, and can arrange them in it. However, since the mesh fin 57 which adheres along the outside surface cuts down the mesh fin material of one sheet circularly and is formed to each heat exchanger tubes 56 and 56 and -- being arranged radiately, there are the following faults.

[0045]That is, as shown in drawing 9 (b), supposing the meshes of a net 59 of the above-mentioned mesh fin 57 have accomplished the rhombus, as the arrangement direction of meshes of a net in the heat exchanger tube 56a in drawing 9 (a) and the arrangement direction of the meshes of a net in the heat exchanger tube 56b show enlarged drawing (\*\*) and (\*\*), it will differ. The direction of the long diagonal line 61 of the rhombus which in the case of the above-mentioned heat exchanger tube 56a constitutes the meshes of a net 60 as shown in enlarged drawing (\*\*) has become in the direction of the heat exchanger tube 56a. On the other hand, the direction of the short diagonal line 63 of the rhombus which in the case of the heat exchanger tube 56b constitutes the meshes of a net 62 as shown in enlarged drawing (\*\*) has become in the direction of the heat exchanger tube 56b. As a result, the contact density with the mesh fin 57 in the heat exchanger tube 56a becomes small as compared with contact density with the mesh fin 57 in the heat exchanger tube 56b, and the heat

transfer coefficient from each heat exchanger tube 56 in a mesh fin heat exchanger to the mesh fin 27 will change with places.

[0046]As mentioned above, since the mesh fin 57 cuts down the mesh fin material of one sheet circularly and forms it, there is a fault that the yield is bad and causes a cost hike.

[0047]Then, in this example, the mesh fin heat exchanger which moves the upper part to the anti-turbo fan position aslant, encloses the circumference of a turbo fan at equal intervals, and can be allocated in reversed conical shape from the mesh fin heat exchange member 71 of one sheet formed in the rectangle as shown in drawing 10 is formed. The mesh fin heat exchange member 71 of the one above-mentioned sheet has the following composition. That is, the heat exchanger tube 65 which adhered to the mesh fin 68 of one sheet is divided into two or more blocks 65a, one end of the heat exchanger tube 65 in each block 65a is connected to the inhalant canal 66, and the other end is connected to the excurrent canal 67. In the mesh fin heat exchange member 71 shown in drawing 10, the heat exchanger tube 65 is arranged in parallel with the edge side 69 of the rectangular mesh fin 68.

[0048]Drawing 11 is a perspective view of the mesh fin heat exchanger in this example. In order to form the mesh fin heat exchanger 72 shown in drawing 11, the both-ends neighborhoods 69 and 69 of the mesh fin heat exchange member 71 of a rectangle as shown in drawing 10 are connected, it accomplishes cylindrical, a fold is formed in one side 70 side, the average radius of the side 70 is made small, and it changes into abbreviated reverse cone type. The degree of the inclination (namely, inclination of the mesh fin heat exchanger 72) of a described [ above ] cone type is adjusted by adjusting the bending amount of the above-mentioned fold in that case.

[0049]Thus, according to this example, the mesh fin heat exchanger 72 which has abbreviated reverse cone type can be easily formed cheaply by the easy method of performing bending to the mesh fin heat exchange member 71 of the rectangle which can be formed. Since the above-mentioned mesh fin heat exchanger 72 formed in this way has abbreviated reverse cone type, All the peripheries of the turbo fan which has a circular section can be surrounded at equal intervals, heat exchange can be carried out efficiently, and arrangement adapted to the blow-off characteristic of the turbo fan as are shown in drawing 12, and aslant moved the upper part to the anti-turbo fan position and shown in drawing 15 can be taken.

[0050]In the mesh fin heat exchanger 72 in this example, since it forms in reversed conical shape by forming a fold in the one side 70 side of the rectangular mesh fin heat exchange member 71, there is no heat exchange surface product loss for forming reversed conical shape, and the fall of heat exchanging quantity can be prevented. Since the arrangement direction of the meshes of a net to all the heat exchanger tubes 65 is the same, the heat transfer coefficient from each heat exchanger tube 65 to the mesh fin 68 does not change with places. Since the heat exchanger tube 65 is arranged perpendicularly, even if heat-exchanging-quantity distribution arises perpendicularly, channeling does not arise on each refrigerant path.

[0051]In this example, although the mesh fin heat exchanger 72 of abbreviated reverse cone type as shown in drawing 11 is formed, this invention is not limited to this. For example, after connecting the both-sides neighborhoods 69 and 69 of the mesh fin heat exchange member 71 first shown in drawing 10 in the case of the turbo fan type ceiling embedded air conditioner of 2 ream type

mentioned above, a center section is narrowed and it is made the shape of "8" characters, and it is made the shape where all the peripheries of two turbo fans installed side by side were met. What is necessary is to provide a fold in one side and just to attach a required inclination to such the back.

[0052]The arrangement forms of the mesh fin heat exchanger in this invention are not limited to each above-mentioned example. What is necessary is just to set up arrangement forms, fill heat exchanging capacity, a product dimension, or a noise level etc. to need in short. In each above-mentioned example, although the cross flow fan type ceiling embedded air conditioner or the turbo fan type ceiling embedded air conditioner is explained to an example, even if adapted for the ceiling flush type air conditioner of other forms, it does not interfere at all.

[0053]

[Effect of the Invention]As mentioned above, since the ceiling flush type air conditioner of the invention concerning claim 1 provides the mesh fin heat exchanger which has a fin of mesh shape so that clearly, even if it has flexible nature and a heat exchanger makes it incline, the drain omission of it is not carried out and the arrangement forms of a heat exchanger have flexibility. Therefore, the arrangement forms of the optimal mesh fin heat exchanger for miniaturization, low-noise-izing, or a cost cut can be set up. That is, according to this invention, miniaturization, low-noise-izing, a cost cut, or high temperature efficiency-ization can provide a possible ceiling flush type air conditioner easily.

[0054]Since the ceiling flush type air conditioner of the invention concerning claim 2 pushes down aslant the above-mentioned mesh fin heat exchanger upper part and is allocating it in the anti-fan side, it can attain slimming down, securing a required heat exchange surface product. In that case, since the drain omission of the above-mentioned mesh fin heat exchanger is not carried out, it does not need to provide the 2nd drain pan, and there is nothing used as the hindrance of miniaturization, the formation of high temperature efficiency, and low-noise-izing.

[0055]The ceiling flush type air conditioner of the invention concerning claim 3, Since it formed so that a fold might be provided in the 1 side side of the tubed mesh fin heat exchange member which connected and accomplished the both-ends neighborhoods of the mesh fin of the rectangle which adhered the mesh fin heat exchanger to the outside surface of the heat exchanger tube arranged by surface state and the average caliber of the one above-mentioned side might become narrower than the caliber of other sides, The mesh fin heat exchanger which can be allocated aslant can be easily formed by easy bending using the mesh fin heat exchange member of the rectangle which can be created. Therefore, according to this invention, the ceiling flush type air conditioner which can attain miniaturization, low-noise-izing, and high temperature efficiency-ization can be provided still more cheaply.

[0056]Since the above-mentioned mesh fin heat exchanger can be formed by the mesh fin heat exchange member of a rectangle with sufficient heat exchanging efficiency and it can allocate at equal intervals in accordance with all the peripheries of a turbo fan in that case, a more efficient ceiling flush type air conditioner can be provided.

[0057]The ceiling flush type air conditioner of the invention concerning claim 4, Since the mesh fin heat exchanger was allocated so that the entrance of the passage which is in the blow-off side air duct between a turbo fan and an outlet, and opens the above-mentioned outlet air duct and an outlet for free passage might be plugged up, The air after heat exchange was carried out by the above-mentioned mesh fin

heat exchanger blows off to an outlet, without touching on a casing. Therefore, it does not dew in the above-mentioned casing. That is, it is not necessary to spread thermal insulation around in the above-mentioned casing, and, according to this invention, the further cost cut and miniaturization can be attained.

[0058]The ceiling flush type air conditioner of the invention concerning claim 5, Since the side of the above-mentioned cross flow fan in the suction side air duct between a suction opening and a cross flow fan was surrounded perpendicularly and the mesh fin heat exchanger was allocated, The difference between positions of the angle to the mesh fin heat exchanger in the streamline of airstream produced by rotation of the above-mentioned cross flow fan can be made small. Therefore, according to this invention, pressure loss at the time of mesh fin heat exchanger passage can be made small, improvement in the further heat exchanging efficiency can be aimed at and combined, and the further miniaturization can be attained.

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[Translation done.]